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OSTEOLOGY OF UPPER CRETACEOUS LIZARDS FROM  
UTAH, WITH A DESCRIPTION OF A NEW SPECIES

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IN a preliminary paper<sup>1</sup> the new genus and species *Paraglyphanodon utahensis* was briefly characterized. It is now proposed to give a more complete description of the type specimen and to describe a second species found in the collection made in 1940 by a Smithsonian paleontological expedition under the leadership of Dr. C. L. Gazin. The illustrations were all drawn by Sydney Prentice.

Suborder SAURIA

Family POLYGLYPHANODONTIDAE Gilmore

Genus PARAGLYPHANODON Gilmore

*Paraglyphanodon* Gilmore, Smithsonian Misc. Coll., vol. 99, No. 6, p. 3, 1940.

*Etymology*.—παρά, beside + γλύφανος, chisel + ὀδούς, tooth.

*Genotype*.—*Paraglyphanodon utahensis* Gilmore.

*Diagnosis*.—Dentition subacerodont, heterodont; teeth short, stout, with sharp lateral and transverse cutting edges; anterior teeth reduced, with transversely compressed crowns; vertebrae procoelous; no evidence of zygosphene-zygantrum articulation; size of animal small.

*Relationships*.—On the basis of the dentition *Paraglyphanodon* seems to have its nearest affinities with its contemporary *Polyglyphanodon*.<sup>2</sup> Such relationship is suggested by the general plan of the dental series: (1) Similarity of crown structure; (2) presence of a

<sup>1</sup> Smithsonian Misc. Coll., vol. 99, No. 6, p. 3, 1940.

<sup>2</sup> Gilmore, Charles W., Smithsonian Misc. Coll., vol. 99, No. 16, p. 1, fig. 1, 1940.

much-reduced last molar; (3) widening of the intermediate teeth with sharp transverse cutting edges; (4) progressive reduction of anterior teeth to those having simple crowns. In view of these suggested affinities, the present genus is tentatively assigned to the family Polyglyphanodontidae.<sup>3</sup>

Attention is called to the possibility that *Coniosaurus crassus*,<sup>4</sup> from the Cretaceous Chalk of Sussex, England, may eventually find a resting place in this same family. This suggestion is made on the basis of its small size, reduced posterior molar, a tendency of intermediate teeth to widen transversely, and a reduction in size of the anterior teeth.

#### PARAGLYPHANODON UTAHENSIS Gilmore

*Type*.—U.S.N.M. No. 15668, consisting of a jaw bone containing 8 posterior teeth. In the original description it was identified as a left maxillary, but in the light of new materials it quite certainly repre-

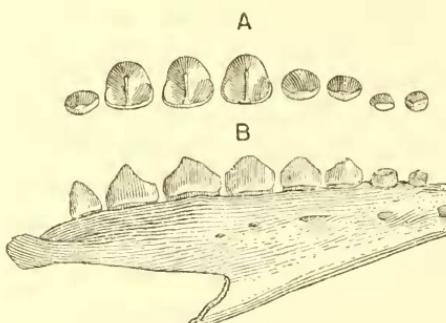


FIGURE 6.—Right dentary of *Paraglyphanodon utahensis* Gilmore: A, Superior view of dentition; B, lateral view of the dentary.  $\times 5$ . U.S.N.M. No. 15668 (type). (After Gilmore.)

sents a right dentary. This specimen was found in the lower part of the North Horn formation, Upper Cretaceous, in close proximity to the paratype of *Polyglyphanodon sternbergi* (U.S.N.M. No. 15816).

*Description*.—The anterior end of the type dentary is missing, but the lost part left its impression on the small block of matrix in which it is preserved, and this impression gives evidence that there were probably 11 teeth in the complete dentary series. These occupied a space 11.5 mm. long. The teeth increase in size from front to back, with a much-reduced posterior tooth as in *Polyglyphanodon*. The teeth are subacrodont, ankylosed to the sides of shallow alveolar depressions.

Viewed laterally the teeth are short and stout, with subacute, equilateral, triangular crowns, the apex being centrally placed (see fig. 6, B). Viewed from above, however, the heterodont nature of the teeth (fig. 6,

<sup>3</sup> Gilmore, Charles W., Proc. U. S. Nat. Mus., vol. 92, p. 229, 1942.

<sup>4</sup> Owen, R., A monograph of the fossil Reptilia of the Cretaceous formations, pt. I, p. 21, pl. 9, figs. 13–15, 1851. Paleontographical Society, London.

A) is at once evident. The anterior teeth have transversely compressed crowns that swell inward at the base. The fourth tooth from the front of the present series has an incipient vertical ridge developed on the inner side of the crown that divides this face into two unequal parts, the posterior being the larger. The three teeth that follow, the fifth, sixth, and seventh, widen abruptly transversely and display a sharp transverse cutting edge that extends inward at right angles to the outer cutting edge. This transverse edge is at a slightly lower level than the apex of the outer side. The smooth, sharp transverse edge strongly suggests a functional use similar to that of *Polyglyphanodon*. The last tooth of the series is much reduced in size, the fore and aft and transverse diameters being about half the dimensions of those of the preceding tooth. It also retains a reduced inner cutting edge, shown clearly in specimen U.S.N.M. No. 15876. The bases of the crowns of practically all the teeth swell out and then contract sharply to the roots.

**PARAGLYPHANODON GAZINI, new species**

*Type*.—U.S.N.M. No. 16580, consisting of an imperfect skull, articulated with the lower jaws, upper and lower teeth, associated with short sections of articulated vertebrae, and fragmentary ribs. Collected in 1940.

*Locality*.—South Dragon, "lizard locality," Manti National Forest, Emery County, Utah.

*Horizon*.—North Horn formation, Upper Cretaceous.

*Description*.—The specimen selected as the type of this species was collected from the same level and in association with specimens of *Polyglyphanodon sternbergi* and *Paraglyphanodon utahensis*. The poorly preserved skull has been worked out in relief on a small block of matrix, and fragmentary though it may be it gives the first information of the cranial structure of *Paraglyphanodon*. The skull consists of the incomplete parietofrontal region, the right postorbital, impression in the matrix of the right jugal, and the imperfect left maxillary and the alveolar border of the right. There are four teeth in the left maxillary and fragments of two in the right maxillary. The left ramus, which has been fully freed from the matrix, carries a series of six posterior teeth but lacks the tip. The anterior half of the right dentary is missing, but the posterior portion bears five teeth. The right quadrate is preserved in situ, as shown in figure 7.

At this time its larger size and the differences found in the dentition distinguish this new species from its contemporary, *P. utahensis*.

The preservation in the matrix of much of the profile of the right side provided sufficient evidence for the reconstruction illustrated in fig. 7. The anterior maxillary portion and the anterior half of the

dentary were drawn from the elements of the left side. The form and size of the orbit are clearly outlined in the matrix, although all the surface bone of the jugal, lachrymal, and prefrontal is missing. The diminutive size of *Paraglyphanodon gazini* is well illustrated by the skull, which has an estimated length over all of 26 mm.

Viewed from above, the parietal minus the posterior processes, the right frontal, small portion of the left, and part of the right postfrontal are present in their natural relationships. The coalescence of all sutures except those joining the nasal bones renders it impossible clearly to delimit these separate elements. The premaxillary region is missing.

The parietal has the usual quadrangular outline, with an undulating superior surface that appears to be perforated by a pineal foramen near its junction with the frontals. Whether this foramen lies wholly within the parietal or whether it is bisected by the frontoparietal suture

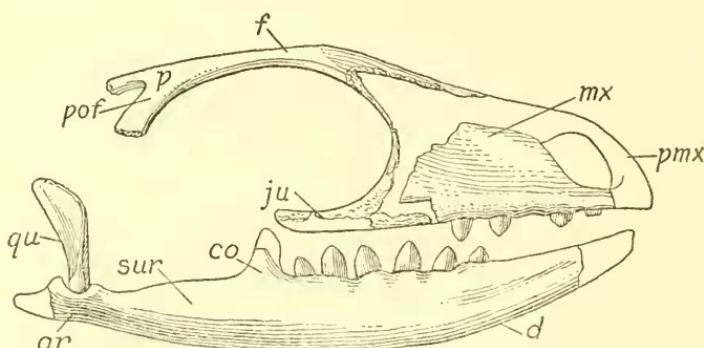


FIGURE 7.—Skull and lower jaw of *Paraglyphanodon gazini* viewed from the right side: *ar*, Articular; *co*, coronoid; *d*, dentary; *f*, frontal; *ju*, jugal; *mx*, maxillary; *p*, parietal; *pmx*, premaxillary; *pof*, postfrontal; *qu*, quadrate; *sur*, surangular.  $\times 3$ . U.S.N.M. No. 16580 (type).

cannot be determined from available materials. On the posterior border of the parietal the upper surface is excavated, thus forming a narrow transverse shelf that is divided into two halves by a raised longitudinal ridge at the center. Between the supratemporal fossae the parietal has a least transverse diameter of 7.5 mm.

The frontals are paired. On the superior outer edge of each frontal a low, raised, longitudinal ridge extends the greater length of the bone.

A portion of the right postfrontal is preserved in the type, but the coalescence of the sutures makes it impossible to determine its manner of junction with the parietal and frontal.

The right quadrate is preserved in articulation with the ramus as shown in figure 7, but its poor preservation renders all structural details obscure.

The mandible is represented by the posterior half of the right ramus and the nearly complete left ramus. This ramus has been freed from the matrix, and although it gives a good idea of the jaw as a whole the complete coalescence of sutures makes it impossible to determine the detailed structure of the jaw.

The dentition is represented by 15 teeth, 6 posterior teeth in the left ramus, 4 in the right ramus, 3 in the left maxilla, and 2 in the remnant of the right maxilla. Comparison of upper and lower teeth fails to disclose differences that would distinguish one from the other (see figs. 8 and 9).



FIGURE 8.—Posterior teeth of left dentary of *Paraglyphanodon gazini*, crown view. Most posterior tooth on the right.  $\times 5$ . U.S.N.M. No. 16580 (type).

In the general plan of the subacrodont dentition the teeth of *Paraglyphanodon gazini* follow those of the genotype in having the anterior teeth reduced and having a small tooth at the posterior end of the series; also there is a similarity in cusp pattern of the larger teeth, in having a sharp transverse cutting edge with an outer cutting edge at right angles to it, though they differ much in other details.

At the present time it is upon characters found in the lower dentition that reliance is placed for distinguishing the present specimen from the type of *Paraglyphanodon utahensis*. The more important of these differences are as follows: Crowns of larger teeth wider transversely



FIGURE 9.—Teeth of left maxillary of *Paraglyphanodon gazini*, crown view. Small tooth in front.  $\times 5$ . U.S.N.M. No. 16580 (type).

and narrower anteroposteriorly, with a relatively longer transverse cutting edge; posterior tooth with a well-developed cusp on the inner side; enumerated from the posterior end of the series, the second and third are subequal in size with a reduced fourth, whereas in *P. utahensis* the second, third, and fourth are subequal with a much reduced fifth tooth. Crowns of fourth and fifth subequal in size, with well-developed transverse cutting edge whereas in *P. utahensis* the crown of the fifth tooth is about half the size of the fourth and both have incipient inner cusps; the crown of the sixth tooth is more robust than *P. utahensis*. The teeth throughout the series are larger and more widely spaced. The six posterior teeth in the left ramus occupy a longitudinal space of 8.6 mm.

*Vertebrae*.—Associated with the skull of specimen U.S.N.M. No. 16580 are 12 vertebrae, in three series of 3, 4, and 5 articulated vertebrae, respectively. The series of five (fig. 10, A) evidently pertains to the dorsal series, as evidenced by the parts of ribs found in association. All the vertebrae are procoelous, with depressed centra. The centra are rounded from side to side on the median ventral surface. On each side of this median rounded portion the surface is traversed by shallow, longitudinal depressions. The ball is set off by a faint annular groove. The character of the articulations for the ribs cannot be determined

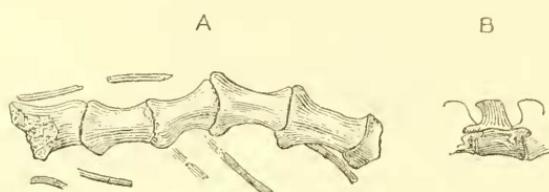


FIGURE 10.—Vertebrae of *Paraglyphanodon gazini*: A, Ventral view of dorsal vertebrae; B, lateral view of anterior thoracic or cervical vertebrae.  $\times 2\frac{1}{2}$ . U.S.N.M. No. 16580 (type).

from the available materials. The five articulated vertebrae illustrated in figure 10, A, have a combined length of 19.4 mm.

A second section of the backbone of this same individual is shown in figure 10, B. These vertebrae are considerably shorter than the dorsals described previously, and it is assumed they pertain either to the anterior dorsal or the posterior cervical series. The zygapophyses are wide apart, with articular faces nearly flat. The border between anterior and posterior zygapophyses is shallowly incised by a wide, open notch. Spine short, rectangular, without transverse enlargement of its top.